AMENDMENTS TO THE CLAIMS

This listing of claims replaces all prior versions, and listings, of claims in the application.

1. (Original) A solid substrate comprising:

(a) a solid support;

(b) a monocyclic or polycyclic group that is heterocyclic, heteroaromatic, or aromatic and that is substituted with a sulfate, sulfonate, phosphate, or phosphonate group; and

(c) a linking group, comprising a mercapto-, ether-, or amino-containing moiety, that links (b) to the solid support.

2. (Original) The solid substrate according to claim 1, wherein the solid support is an organic material.

3. (Original) The solid substrate according to claim 1, wherein the solid support is an inorganic material.

4. (Original) The solid substrate according to claim 2, wherein the organic material is one selected from the group consisting of cellulose, agarose, dextran, polyacrylates, polystyrene, polyacrylamide, polymethacrylamide, copolymers of styrene and divinylbenzene, and mixtures thereof.

5. (Original) The solid substrate according to claim 3, wherein the inorganic material is one selected from the group consisting of hydrogel-containing silica, zirconia, alumina, titania, ceramics, and mixtures thereof.

6. (Original) The solid substrate according to claim 1, wherein the linking group comprises a mercapto-containing moiety.

7. (Original) The solid substrate according to claim 1, wherein the linking group comprises an ether-containing moiety.

8. (Original) The solid substrate according to claim 1, wherein the linking group comprises an amino-containing moiety.

9. (Original) The solid substrate according to claim 1, wherein the moiety of the linking group is a member selected from the group consisting of alkylene groups, alkenylene groups, alkynylene groups, alkyl-oxy groups, aromatic groups, alkylaromatic groups, and combinations thereof.

10. (Original) The solid substrate according to claim 9, wherein the linking group is a mercapto alkyl group.

11. (Original) The solid substrate according to claim 1, wherein the heterocyclic or heteroaromatic group comprises at least one S atom.

12. (Original) The solid substrate according to claim 1, wherein the heterocyclic or heteroaromatic group comprises at least one N atom.

13. (Original) The solid substrate according to claim 1, wherein the heterocyclic or heteroaromatic group comprises at least one S atom and one N atom.

14. (Original) The solid substrate according to claim 1, wherein group (b) is a polycyclic group.

15. (Original) The solid substrate according to claim 14, wherein group (b) comprises a heterocyclic or heteroaromatic group that is fused to an aromatic group.

16. (Original) The solid substrate according to claim 15, wherein the aromatic group is phenyl, naphthyl, anthracenyl, phenanthrenyl, or acenaphthylenyl.

17. (Original) The solid substrate according to claim 14, wherein the heterocyclic or heteroaromatic group comprises at least one S atom.

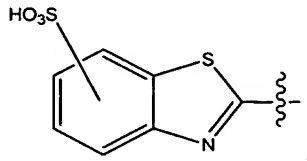
18. (Original) The solid substrate according to claim 14, wherein the heterocyclic or heteroaromatic group further comprises at least one N atom.

19. (Original) The solid substrate according to claim 14, wherein the heterocyclic or heteroaromatic group comprises at least two N atoms.

20. (Original) The solid substrate according to claim 18, wherein the heterocyclic or heteroaromatic group is fused to an aromatic group.

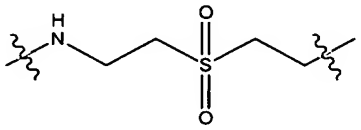
21. (Original) The solid substrate according to claim 20, wherein the heterocyclic or heteroaromatic group is a five- or six-member ring.

22. (Original) The solid substrate according to claim 21, wherein group (c) is represented by the formula:



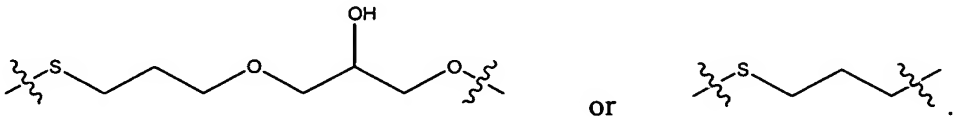
23. (Original) The solid substrate according to claim 22, wherein the linking group is an amino-containing moiety.

24. (Original) The solid substrate according to claim 23, wherein the amino-containing moiety is represented by the formula:



25. (Original) The solid substrate according to claim 22, wherein the linking group is a mercapto-containing moiety.

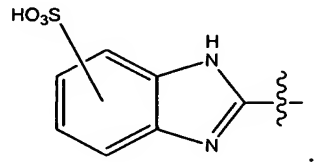
26. (Original) The solid substrate according to claim 25, wherein the mercapto-containing moiety is represented by the formula:



27. (Original) The solid substrate according to claim 14, wherein group (b) comprises a heterocyclic or heteroaromatic group that comprises at least two N atoms and which is fused to an aromatic group.

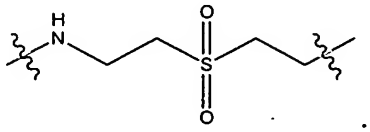
28. (Original) The solid substrate according to claim 27, wherein the heterocyclic or heteroaromatic group is a five- or six-member ring.

29. (Original) The solid substrate according to claim 28, wherein group (b) is represented by the formula:



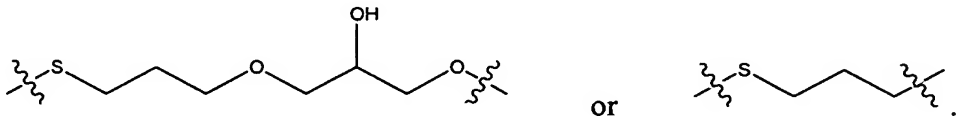
30. (Original) The solid substrate according to claim 29, wherein the linking group is an amino-containing moiety.

31. (Original) The solid substrate according to claim 30, wherein the amino-containing moiety is represented by the formula:



32. (Original) The solid substrate according to claim 29, wherein the linking group is a mercapto-containing moiety.

33. (Original) The solid substrate according to claim 32, wherein the mercapto-containing moiety is represented by the formula:



34. (Original) A method for the separation of biological substances from a sample, comprising:

(a) contacting a solid substrate according to claim 1 with a liquid sample that contains at least one biological substance;

(b) washing the solid substrate obtained in (b) with an equilibration buffer; and

(c) adjusting the pH such that the biological substance desorbs from the solid substrate.

35. (Original) The method according to claim 34, further comprised of adjusting the pH of the sample such that the biological substance adsorbs onto the solid substrate.

36. (Original) The method according to claim 35, wherein the pH in (a) is adjusted to a value between about 4 to about 6.

37. (Original) The method according to claim 34, wherein the pH in (c) is adjusted to a value between about 8 to about 11.

38. (Original) The method according to claim 35, wherein the pH in (a) is adjusted to a value between about 4 to about 6 and the pH in (c) is adjusted to a value between about 8 to about 11.

39. (Original) The method according to claim 34, wherein the separation is accomplished via fixed bed, fluidized bed, or batch chromatography.

40. (Original) The method according to claim 34, wherein the biological substance is selected from proteins, viruses, nucleic acids, carbohydrates, and lipids.

41. (Original) The method according to claim 40 wherein the biological substance is a protein.

42. (Original) The method according to claim 41 wherein the protein is selected from immunoglobulins, hormones, clotting factors, cytokines, peptides, and enzymes.

43. (Original) The method according to claim 42 wherein the protein is an immunoglobulin.

44. (Original) A process for making a solid substrate according to claim 1, comprising:

(i) reacting with the solid support a bifunctional reagent that comprises part or all of the linking group; and

(ii) reacting the product obtained in (i) with a reagent comprising a heterocyclic, heteroaromatic, or aromatic group that is substituted with a sulfonate, phosphate, or phosphonate group, thereby forming a bond between the heterocyclic, heteroaromatic, or aromatic group and the linking group.

45. (Original) he process according to claim 44, wherein the solid support is an organic material.

46. (Original) The process according to claim 44, wherein the solid support is an inorganic material.

47. (Original) The process according to claim 45, wherein the organic material is one selected from the group consisting of cellulose, agarose, dextran, polyacrylates, polystyrene, polyacrylamide, polymethacrylamide, copolymers of styrene and divinyl-benzene, and mixtures thereof.

48. (Original) The process according to claim 46, wherein the inorganic material is one selected from the group consisting of hydrogel-containing silica, zirconia, titania, alumina, ceramics, and mixtures thereof.

49. (Original) The process according to claim 44, wherein the solid support is a biochip.

50. (Original) The process according to claim 44, wherein the bifunctional reagent comprises at least two functional groups independently selected from bromide, iodide, epoxide, carboxyl, ester, aldehyde, ketone, amide, alkene, cyano, and imino.

51. (Original) A chromatography column, comprising:

(a) a tubular member having an inlet end and an outlet end;

(b) first and second porous members disposed within said tubular member; and

(c) a solid substrate according to claim 1 packed within said tubular member between said first and second porous members.

52. (Original) The chromatography column according to claim 51, wherein the column volume is between about 1 microliter and about 5000 liters.

53. (Original) The chromatography column according to claim 52, wherein the column volume is between about 1 liter and about 100 liters.

54. (Original) A chromatography column according to claim 51, further comprising one or more fluid control devices for flowing a liquid sample upward through the solid substrate.

55. (Original) A chromatography column according to claim 51, comprising a series of stages between said inlet end and said outlet end.

56. (Original) The solid substrate according to claim 1 in the form of a biochip.

57. (Original) The solid substrate according to claim 56 wherein the solid support is one selected from the group consisting of a metal, silicon, glass, and organic polymers.

58. (Original) The solid substrate according to claim 56 wherein the biochip is a mass spectrometer probe.

59. (Original) The solid substrate according to claim 56, wherein the monocyclic or polycyclic group is linked to the biochip at a plurality of addressable locations.

60. (Original) The solid substrate according to claim 56 wherein the linking group further comprises a polysaccharide moiety.

61. (Original) A method of detecting an analyte, comprising:

(a) contacting an addressable location of the solid substrate according to claim 59 with a sample comprising the analyte, thereby fixing the analyte to the solid substrate;

(b) introducing the solid substrate into a probe interface of a laser desorption mass spectrometer whereby the addressable location is positioned proximately to a laser beam in the mass spectrometer;

(c) irradiating the solid substrate at the addressable location with a laser pulse for a time and power sufficient to desorb and ionize the analyte; and

(d) detecting the analyte obtained in (c) with the mass spectrometer.

62. (Original) The method according to claim 61, wherein the analyte is selected from proteins, viruses, nucleic acids, carbohydrates, and lipids.

63. (Original) The method according to claim 62 wherein the analyte is a protein.

64. (Original) The method according to claim 63 wherein the protein is selected from immunoglobulins, hormones, clotting factors, cytokines, peptides, and enzymes.

65. (Original) The method according to claim 64 wherein the protein is an immunoglobulin.

66. (Original) The solid substrate according to claim 1, wherein the solid support is a chip.

67. (Original) The solid substrate according to claim 66, wherein the solid support further comprises a covalently attached silyl layer to which is covalently bound a layer comprising a cross-linked polysaccharide.

68. (Original) The solid substrate according to claim 67, wherein the cross-linked polysaccharide is a copolymer of a first polysaccharide and a second polysaccharide that is substituted with one or more cross-linking groups.

69. (Original) The solid substrate according to claim 67, wherein the first and second polysaccharides are selected from the group consisting of dextran, hydroxy-ethyl-cellulose, starch, amylase, and agarose.

70. (Original) The solid substrate according to claim 69 wherein the polysaccharides are dextran.

71. (Original) The solid substrate according to claim 70, wherein the cross-linking groups are benzophenone groups.

72. (Original) The solid substrate according to claim 66, wherein the linking groups link a monocyclic or polycyclic group to the solid substrate at a plurality of different addressable locations.

73. (Original) The solid substrate according to claim 72, wherein at least two different addressable locations comprise the same linking and monocyclic or polycyclic groups.

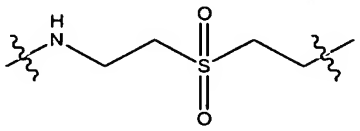
74. (Original) The solid substrate according to claim 73, wherein the solid support is alumina or silica.

Please add the following claims.

75. (New) The solid substrate of claim 1, wherein (b) is a polycyclic group comprising at least one aromatic group fused to a heterocyclic or heteroaromatic group, and that is substituted with a sulfate, sulfonate, phosphate, or phosphonate group.

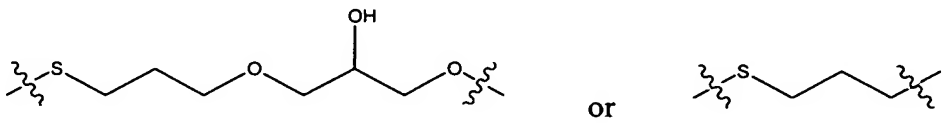
76. (New) The solid substrate of claim 75, wherein the linking group is an amino-containing moiety.

77. (New) The solid substrate of claim 76, wherein the amino-containing moiety is represented by the formula:



78. (New) The solid substrate of claim 75, wherein the linking group is a mercapto-containing moiety.

79. (New) The solid substrate of claim 78, wherein the mercapto-containing moiety is represented by the formula:



80. (New) The solid substrate of claim 75, wherein the polycyclic group is substituted with a sulfate group.

81. (New) The solid substrate of claim 75, wherein the heterocyclic or heteroaromatic group comprises a heteroatom chosen from N, O, and S.